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OPERATING COAL MINES WITHOUT ACCIDENTS

BY

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OPERATING COAL MINES WITHOUT ACCIDENTS[1]

By D. Harrington[2] and W. J. Fene[3]

Coal mines and mining, as well as metal and nonmetallic mines and mining, are not inherently unsafe, although mining people think they are and would like to have everyone else think so. It is now being demonstrated that mines can be operated with essentially as much safety as any other major industrial enterprise; but most mining people, including workers as well as officials, have been slow to realize or admit this.

In the past, and with most people even at present, the idea has prevailed that it is utterly impossible to operate a mine without accidents. Although, as in all other kinds of industrial activity, it is true that some injury is likely on occasion to occur to some workers and an extraordinary accident may occur to one or more persons under exceptional conditions, mines can be operated with few if any accidents if a reasonable amount of the right kind of precautionary effort is exerted and kept in effect.

After publication of a considerable amount of well-authenticated data indicating that cement plants, some with large numbers of workers, operated nearly full time for a year or more without a lost-time accident and that underground iron-ore mines were also operating for months, many of them for a year or more, without a lost-time accident, a few coal mines began to discard the tradition that accidents absolutely must occur in the mining of coal and began to consider accident occurrence in terms of no lost-time accidents for a month or thereabouts rather than to confine activities entirely to prevention of fatalities. It was not, however, until within the past few years that coal mines actually attempted to operate as long as a year without a lost-time accident or came forward with records well-supported by evidence that coal mines with a fair complement of workers and producing reasonably heavy tonnage could be worked for weeks or months or even for a year or more without a lost-time accident.

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In 1923 the Portland Cement Association, trying to decrease accident occurrence in its 100 or more plants, including quarries and in some instance underground mines, offered a trophy to any entire plant in the association that would burn clinkers more than 6 months and operate through an entire year--January 1 to December 31, inclusive--without a lost-time accident. Those who formulated the offer were of the opinion that no plant could possibl operate through an entire year without a lost-time accident, but it was expected that in trying to achieve this very difficult goal there would be at least an approach to it and in the effort accidents with their manifold miseries and heavy costs would at least be reduced.

During the first year, 1923, no plant was able to operate without a lost-time accident, although a trophy was given to the plant with the best accident record; but the next year one plant won the trophy, the third year 2 plants won, and each succeeding year greater numbers won until 1931 when 42 plants of 122 in the contest worked through the year without a lost-time accident and 36 won trophies, the other 6 not having operated sufficiently to qualify for receiving a trophy. Hence what was considered an utter impossibility for any cement plant when the safety campaign was started in 1923 was actually accomplished by more than one third of all the plants in the contest in 1931.

By the end of 1932, 12 plants had operated more than 1,000 days each without a lost-time accident and 2 of them--The Iola Plant, Lehigh Portland Cement Co., Iola, Kansas, and the Ironton, Ohio, plant of the Alpha Portland Cement Co.--had each worked 6 consecutive years without a lost-time accident. Moreover, 1 cement plant by the end of 1932 had worked an underground mine for more than 6 years without a lost-time accident, and in that period the mine had been in actual operation for more than 1,000 days and had averaged over 1,000 tons of rock produced per day of operation.

Iron-ore mines in the Lake Superior region, as well as some of the lead-zinc properties of the Tri-State district near Picher, Okla., started several years ago to show that mines--both open-pit and underground operations--could be worked long periods, not only without fatal or serious accidents but even without occurrence of lost-time accidents or any accident that would not allow the victim to return to his regular work on the following day.

Although unquestionably the majority of those engaged in both coal mining and metal mining still cling to the idea that accidents of nearly all kinds, including fatalities and occasionally a multiple accident or disaster, are sure to happen as long as mining is done; on the other hand, it is decidedly encouraging to note the number of progressive coal, metal, and nonmetal companies now handling accident-prevention activities along the line of operating long periods without lost-time accidents and feeling--virtually knowing--that with the proper procedure mines can be operated without accidents.

Most coal mines, however, have continued to be operated in the belief (in which practically every one in the industry participated or participates) that coal mining is so inherently hazardous that not only serious accidents (including permanent partial or permanent total disabilities) but fatalities as well must occur as long as mining is done; that every coal mine should expect one or more fatalities per year; and that the coal mine which escaped disasters, such as fires or explosions, with multiple loss of life, could count itself exceptionally fortunate.

The success or failure of the safety movement depends to a great extent upon the attitude taken by the individual company through its operating executives. Safety in coal mining can only be brought about by unity of mind and purpose of the managing officials and the employees. Proof that coal mining can be conducted without accidents is shown by the experience of 12 individual companies who have operated their mines 1 to 2 years without lost-time accidents. Table 1 shows a record of mines that have operated 1 year or more without a lost-time accident; there may be other mines that have equally as good records as those listed, but their records are not available. It is shown that three mines operated well over one half million man-hours without a lost-time accident and that four mines operated over one quarter million hours. Certain mines were continuing to operate without lost-time accidents after the end of the period shown.

OUTSTANDING SAFETY RECORDS

1. Alloy Mine

The Alloy mine of the Electro-Metallurgical Co. at Alloy, W. Va., operated without a lost-time accident for nearly 2 full years--March 14, 1931 to March 1, 1933--with a production of 234,977 tons of coal, a total of 541,185 man-hours worked by an average of 130 employees.

This is one of the best coal-mining safety records available from the viewpoint of long-time operation and man-hours of exposure without a lost-time accident.

The Electro-Metallurgical Co. is a subsidiary of the Union Carbide Co., New York. The Alloy mine is operating in the No. 2 Gas coal bed, which averages about 4 feet in thickness. The mine is developed by drifts, with the room-and-pillar system of mining, and is more or less in its development stage; it is rated as nongassy. The roof is exceptionally weak over the greater part of the mine and requires heavy and careful timbering. Haulage is mechanical; all coal is undercut and blasted with permissible explosives, and loading is by hand.

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Table 1. - Record of mines that have operated 1 year or more without a lost-time accident

Mine	Operator	Place	Period, months	Men em-ployed	Coal mined, tons	Exposure, man-hours
Alloy	Electro-Metallurgical Co.	Alloy, W. Va.	23-1/2	130	234,977	541,185
Dehue	Youngstown Mines Corporation	Dehue, W. Va.	20	214	356,805	531,382
Imboden	Stonega Coke & Coal Co.	Imboden, Va.	15-1/2	198	231,469	509,232
Brier Hill	Buckeye Coal Co.	Brier Hill, Pa.	12	257	184,306	343,363
No. 1	Phelps-Dodge Corporation	Dawson, N. Mex.	12	70	68,237	1/ 12,905
Orenda	Davis Coal & Coke Co.	Boswell, Pa.	13-1/2	180	129,841	279,393
Steubenville	Consumers Mining Co.	Steubenville, Ohio	24	84	128,630	230,732
Hull	DeBardeleben Coal Corporation	Dora, Ala.	2/ 12	160	100,699	301,763
Weyanoke	Weyanoke Coal & Coke Co.	Lowe, W. Va.	12	100	125,000	146,589
Mossboro	Black Diamond Coal Mining Co.	Mossboro, Ala.	15	50	44,436	144,925
No. 1	Block Coal & Coke Co.	Block, Tenn.	13	115	67,832	-
Rockvalo No. 3	Colorado Fuel & Iron Co.	Canon City, Colo.	12	60	41,154	-

1/ Man-shifts.
2/ This record actually covered 11 months and 20 days in the calendar year 1930.

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2. Dehue Mine

The Dehue mine of the Youngstown Mines Corporation at Dehue, W. Va., operated 602 days without a lost-time accident from January 7, 1931 to August 31, 1932, with an average of 214 men working 531,382 man-hours and producing 356,805 tons of coal.

The mine has consistently maintained a good safety record for a number of years, and the record above is one of the best known from the standpoint of the number of man-hours of exposure and tons of coal produced without a lost-time accident. This mine was awarded certificates of honor by the Joseph A. Holmes Safety Association for meritorious safety records during 1932 and 1933.

The Youngstown Mines Corporation is a subsidiary of the Youngstown Sheet & Tube Co. The Dehue mine is operated through two shafts and two slopes in the Eagle coal bed, which averages about 5 feet in thickness. Development consists of two multiple systems of headings--one of 8 parallel entries and the other of 12. The room-and-pillar method of mining is employed, with pillars recovered on the retreat by machine methods. The roof is fairly good. The mine is classed as gassy; closed lights and permissible explosives are used, and the mine is thoroughly rock-dusted. Haulage is mechanical and all coal is undercut and loaded by hand.

3. Imboden Mine

The Imboden mine of the Stonega Coke & Coal Co., Imboden, W. Va., operated without a lost-time accident from March 20, 1931 to July 8, 1932, or 475 calendar days, with a production of 231,469 tons of coal and a total of 509,232 man-hours of exposure by an average of 198 employees.

The Imboden mine has made remarkable progress in safety by adopting modern safety measures. Two fatalities have occurred since July 18, 1929, with well over 2 million man-hours exposure.

This is a drift mine operating in the Imboden coal bed, which averages 5 feet in thickness and is worked by the room-and-pillar method of mining. Pillars are recovered on the retreat by the open-end method. The immediate roof is a weak slate and requires much timbering. Haulage is mechanical. The mine is rated as nongassy. The coal is centercut and loaded by hand.

4. Brier Hill Mine

The Brier Hill mine of the Buckeye Coal Co., Pine Hill, Pa., operated from December 10, 1930 to December 11, 1931 without a fatality or a disability exceeding the day of the injury, with a production of 184,306 tons of coal by an average of 287 men for a total of 343,363 man-hours.

The mine, operated through a shaft 654 feet deep, is working the Pittsburgh coal bed, which averages 84 inches in thickness. The advance work was by the room-and-pillar method, but all work at the present is retreating,

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mining pillars, and stumps. The mine is rated as gassy, and fire bosses are employed. The mine is rock-dusted. Haulage is by trolley locomotives and animals. The roof is bad, and considerable timbering, including forepoling in some places, is necessary. All coal is undercut and loaded by hand. This property is a subsidiary of the Youngstown Sheet & Tube Co., which also is understood to control the Dehue mine.

5. Dawson No. 1

The Dawson No. 1 mine of the Phelps-Dodge Corporation, Dawson, N. Mex., worked the entire year 1931 without a lost-time accident. During this period 70 underground employees worked 12,905 man-hour shifts and produced 68,237 tons of coal. During 1930 this mine had only 4 lost-time accidents and has a record of 445 consecutive days worked with no lost-time accidents.

Mine No. 1 is opened by a drift and is working the Blossburg coal bed, which averages 6 feet in thickness. The production is largely from pillar extraction with exceptionally bad roof conditions. The mine is extremely dry, being in a semi-arid country and at an elevation of 6,500 feet. It is thoroughly rock-dusted, and face regions and broken coal are thoroughly wetted. The mine is rated as gassy. Permissible explosives are used, and shots are fired from outside the mine. Coal is undercut, and loading is both mechanical and hand.

6. Orenda Mine

The Orenda mine of the Davis Coal & Coke Co., Boswell, Pa., operated without a lost-time accident from December 14, 1931 to January 31, 1933, a period of 13-1/2 months, with an average of 130 men working 279,393 man-hours and producing 129,841 tons of coal.

The Orenda mine is opened by a slope into the C Prime coal bed, which averages 60 inches in thickness and has an average pitch upward of 10 percent. About 60 percent of the production was from pillar workings.

7. Steubenville Mine

The Steubenville Mine of the Consumers Mining Co., Steubenville, Ohio, operated without a lost-time accident during 744 days from January 4, 1931, to January 9, 1933, with an average of 34 men working 230,732 man-hours and producing 129,630 tons of coal.

The Steubenville mine is operated through a shaft into the Freeport No. 6 coal bed, which averages 3-1/2 feet in thickness. About 85 percent of the production was from pillar workings.

8. Hull Mine

The Hull mine of the DeBardeleben Coal Corporation, Dora, Ala., operated 11 months and 20 days in 1930 without a lost-time accident, with an average of 16 men working 301,763 man-hours and producing 100,699 tons of coal; this mine also operated the first 11 months of 1929 with only 2 lost-time accidents and 7 days lost.

The Hull mine is opened by a drift into the Mary Lee coal bed, which averages about 6-1/2 feet in thickness. The room-and-pillar method of mining is used and pillars are recovered on the retreat. The mine is rated as non-gassy.

9. Weyanoke Mine

The Weyanoke mine of the Weyanoke Coal & Coke Co., Lowe, W. Va., operated without a lost-time accident during 1932 with an average of 100 men working 146,589 man-hours in the production of 125,000 tons of coal.

The Weyanoke mine is opened by a drift into the Pocohontas No. 3 coal bed, which averages 56 inches in thickness.

10. Mossboro Mine

The Mossboro mine of the Black Diamond Coal Mining Co., Mossboro, Ala., operated without a lost-time accident from October 1, 1931 to December 31, 1932, with 144,925 man-hours of exposure and a production of 44,436 tons of coal.

The Mossboro mine is operated through a slope in the Buck coal bed, which averages 40 inches in thickness and dips 20 to 25°. The mine is rated as gassy, and rock-dusting and sprinkling are employed.

11. Block No. 1 Mine

The No. 1 mine of the Block Coal & Coke Co., Block, Tenn., operated without a lost-time accident from May 26, 1931 to July 1, 1933, employing an average of 115 men in the production of 67,832 tons of coal.

The Block No. 1 mine is opened by a drift into the Dean coal bed, which averages 5 feet in thickness.

12. Rockvale No. 3 Mine

The Rockvale No. 3 mine of the Colorado Fuel & Iron Co., Canon City, Colo., operated without a lost-time accident from June 22, 1931 to June 24, 1932, with a production of 41,134 tons of coal. This mine operated from June 1904 to December 31, 1932, or 28-1/2 years, without a fatality.

The Rockvale No. 3 mine is operating through a slope in the Canon coal bed, which is about 6 feet thick.

Table 2. - Records of some mines operated without lost-time accidents

Mine	Operator	Place	Period	Men employed	Coal mined, tons	Exposure, man-hours	Remarks
Nellis	American Rolling Mill co.	Nellis, W. Va.	43 mos.	--	1,080,733	144,831	Applies only to haulage employees. No lost-time accidents.
Hammond	Philadelphia & Reading Coal & Iron Co.	Girardville, Pa.	77 days	508	158,180	312,925	Gassy anthracite mine on pitches up to 65°.
No. 9	Rockhill Coal & Iron Co.	Wood, Pa.	329 days	251	154,000	416,000	Anthracite mine, 10 to 70° pitch. No lost-time accident.
Coke Works	Stonega Coke & Coal Co.	Stonega, Va.	37 mos.	--	Coke 203,711	539,223	One lost-time accident. No fatals for 14 years.
Beech Bottom	Windsor Power House Coal Co.	Windsor Heights, W. Va.	10 mos.	403	398,827	--	No lost-time accidents.
Brookside	Philadelphia & Reading Coal & Iron Co.	Tower City, Pa.	3 mos.	1,000	144,451	--	5 lost-time accidents.
Nellis	American Rolling Mill Co.	Nellis, W. Va.	7 mos.	300	176,750	--	No lost-time accidents.
Empire	DeBardeleben Coal Corporation.	Empire, Ala.	18 mos.	135	--	--	135 negro miners. No lost-time accidents.
No. 2	Utah Fuel Co.	Castle Gate, Utah	74 days	--	--	--	No lost-time accidents.
No. 3	do.	do.	200 days	30	--	--	do.
Benoit	Black Diamond Coal Mining Co.	Benoit, Ala.	14-1/2 mos.	100	74,987	235,770	1 lost-time accident.

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Other Excellent Records

Table 2 shows the records of some mines that have operated for long periods with only few lost-time accidents. It is observed that the haulage employees of the American Rolling Mill Co. mine at Nellis, W. Va., operated for 43 months or 144,831 man-hours, handling 1,080,733 tons of coal without a lost-time accident. The employees of the coke works of the Stonega Coke & Coal Co., Stonega, Va., worked 37 months with 539,223 man-hours of exposure with only one lost-time accident. The records of the two anthracite mines shown in table 2 are remarkable in that the natural conditions present many more hazards than ordinarily found in bituminous mining.

A significant fact noted from the list of mines that have gone for long periods without lost-time accidents is that 33 percent of them are operated by companies that are subsidiaries of companies in other industries. This fact would indicate that essentially the same safety policies as are used in the other industries are effective when applied to coal mines.

METHODS USED TO OBTAIN NO-ACCIDENT RECORDS

It is of interest to know how the good safety records of these mines were attained. Virtually all these records were made possible only by acceptance of responsibility for accidents and accident occurrence by company executives, in the belief that accidents can be prevented. Some of the factors that entered into making these records possible are:

1. In most cases the executives of the company took a personal part in securing the sustained interest of all employees in safety measures, as they realized that safety in and around mines is largely a problem of mine management and mine safety organization.

2. Some type of safety organization was generally established, and all supervising officials were expected to take an active part. As a rule meetings were held monthly, and in at least some cases all employees were required to attend. Accidents occurring at the mine were discussed at these regular meetings, and employees were encouraged to report hazards and dangerous practices observed by them. The safety education of the employees was accomplished largely through these meetings.

3. Safety rules and suggestions were transmitted to the employees through daily verbal instruction by the official.

4. Well-designed bulletin boards were in many instances placed at strategic locations for the instruction of employees.

5. Employees of several mining plants were given a rigid physical examination. New employees were examined and placed in positions for which they were best fitted, and prospective employees who could not meet the rigid requirements were not hired.

6. Rigid discipline was inaugurated and maintained. Carelessness by workmen or officials was not tolerated. Employees who persisted in using careless methods of working were usually discharged, while somewhat less severe penalties were applied to employees whose violation of safety rules or regulations appeared to be due to lack of information rather than to premeditation.

7. Usually wage scales were maintained at a level slightly above the prevalent scale of the district, and employees were given other evidences that the employer was attempting to "play fair" with them.

8. Friendly rivalry among employees was encouraged in some mines by the free distribution of small prizes to those on any section which had worked an entire month without a lost-time accident.

9. Safety was made an important factor in the scheme of production in essentially every mine which had these good safety records.

10. The safety engineer was an integral part of the management in at least some of the mines listed as having achieved eminence in safety performance.

11. All hazards were recognized as potential causes of accidents by several of these mines.

12. A definite program was placed in effect looking to the elimination of such hazards as could be removed from these mines; in other words, the good safety record was brought about by concerted, well-directed effort.

13. Printed rules were posted or issued in pamphlet form governing procedure in dealing with such hazards as could be eliminated; in this manner the employer acquainted the worker not only with the attitude of the company toward safety but also with the minimum requirements of the company as to safe practices.

14. Discipline was maintained from the top of the organization down; close study of the conditions under which these very fine coal-mine accident records were attained appears to indicate that the determining factor was firm but just discipline by a supervisory force able to secure cooperation of the worker.

15. A state of "safety-mindedness" or the appreciation of the disciplinary measures invoked was developed, and in this education not only of the worker but also of the supervisory official was essential.

16. The degree of cooperation of the employees was in large measure secured by the evidence of earnestness with which the company conducted the safety program; where the major responsibility for accident prevention was accepted by the operating officials and definite efforts made to remedy

substandard conditions and eliminate dangerous practices, the worker was usually inclined to try to do his share when told what to do. Some of the improvements made by companies which had these very good safety records were as follows, in general the improvements having been made before the company tried to put the safety campaign before the workers:

a. The best and safest type of equipment was purchased and put into service.

b. Moving parts of machinery where feasible were protected by guards.

c. Haulageways were cleared of debris and tracks overhauled and improved.

d. Adequate clearance was provided along haulageways.

e. Loose roof was taken down or properly timbered, in some cases with steel or steel and brick sets.

f. Improved ventilation was provided and maintained.

f. Improvements of various kinds were made in blasting practices.

h. Power wires and equipment, electrical and otherwise, were efficiently installed, guarded, and kept in good repair.

17. Ten of the twelve mines listed in table 1 as having achieved outstanding, no-lost time accident records, had received Bureau of Mines certificates indicating that the entire personnel had been give the Bureau of Mines course in first aid; the training was done before the record was made in most instances and during the making of the record in others.

CONCLUSIONS

On the basis of the 1930 fatal and nonfatal injury record for the bituminous industry of the United States the mines listed in table 1 avoided approximately 6 fatalities and 258 nonfatal injuries during the period of their operation without lost-time accidents. In considering the economic saving to the mining companies by the elimination of these fatalities and injuries it is estimated that a direct saving of approximately $50,000 or a total saving (directly and indirectly) of about $300,000 was made; and this does not take into consideration the savings of numerous kinds--economic, humanitarian, social, and otherwise--to the workers whose lives and limbs were kept from jeopardy.

As a rule, a safe mine is an efficient mine, and safety is now fairly well associated with lower rather than higher cost of production. It is significant that approximately 58 percent of the companies shown in table 1 as having operated 1 year or more without a lost-time accident are subsidiary companies, which would indicate that the safety policy of the parent company, when applied intelligently to its coal mines, produces safety results comparable with those achieved by the parent company in its other industrial operations.

That accidents in coal mines can be very greatly reduced if not entirely eliminated has been conclusively demonstrated by the records of the companies described above. These records were not attained by chance; they were the results of intelligent and sincere efforts on the part of the mine managements who consider the problem of preventing accidents as an important part of coal production, and of the workers whose active cooperation was secured generally by this well-formulated, well-directed educational effort.